Melanomas are aggressive, frequently metastatic tumors responsible for 75 percent of skin cancer deaths. Advanced melanoma is generally difficult to treat, and a significant portion of patients will develop distant metastases even with early intervention. Given the continually rising incidence of melanoma — despite education about minimizing exposure to sunlight — there is a need for more effective prevention, especially in high-risk individuals. Our plant-based oral drug could work together with behavioral modifications to minimize the risk of melanoma.

Technology Description
The key ingredient of our drug is sulforaphane (SFN), which is a naturally-occurring anti-cancer compound found in low concentrations in vegetables, such as broccoli, cabbage, and cauliflower. Using enzymatic digestion of broccoli sprouts, we prepared capsules to provide people with a fixed quantity of SFN. In mice, this formulation and dosage delayed melanoma progression. Additionally, we identified possible SFN-related biomarkers for the progression of atypical moles to melanoma. We tested these biomarkers in a randomized, comparative study in human subjects with melanoma-dependent atypical nevi — a precursor and risk factor for melanoma.

Advantages
- Potential to prevent the development of melanoma
- Natural product with no significant toxicity or side effects
- Delivered orally

Applications
- Reduce the development of melanoma precursor lesions
- Slow the progression of atypical moles into melanoma
- Potentially applicable to other types of cancer

Stage of Development
Phase 1 clinical trial complete

IP Status
U.S. Patent 9,393,225 issued

An example human atypical nevus shows a slight decrease in size after just 28 days of oral SFN treatment. On average, nevi increased in size over the study interval, but the degree of enlargement tended to be less for people who received a higher dose of SFN.

Oral SFN has a dose-dependent effect on plasma SFN concentration in humans.
Dr. John Kirkwood’s laboratory is engaged in the study of melanoma immunobiology. He is also engaged in the assessment of multiple new immunomodulators through trials conducted with the Hillman Melanoma Program, the SPORE in Melanoma and Skin Cancer, and the International Melanoma Working Group.

**Education**
MD, Yale University

**Relevant Publications**

Dr. Shivendra Singh’s research revolves around glutathione transferases (GSTs), which play an important role in drug metabolism and cellular defense against environmental and dietary chemical carcinogens (e.g., polycyclic aromatic hydrocarbons or PAHs). The Singh laboratory is also interested in investigating the anticarcinogenic effects of certain natural agents found in edible plants, including organosulfides from garlic and isothiocyanates from cruciferous vegetables such as broccoli.

**Education**
PhD, Banaras Hindu University, India
MSc, Banaras Hindu University, India

**Relevant Publications**

Dr. Jan H. Beumer is intimately involved in the design, execution, supervision, and data analysis of numerous pharmacokinetic and metabolic studies of anti-cancer drugs covering the entire spectrum from preclinical to clinical phase II studies.

**Education**
PhD, Utrecht University
PharmD, Utrecht University

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